SUBSTITUTE SPECIFICATION (all changes shown)

X-RAY ABSORBING [MATERIALS ( ] MATERIAL AND VARIANTS [ )]

BACKGROUND OF THE INVENTION

[Field of engineering.] Field of the Invention.

The invention relates to X-ray contrasting and X-ray protection materials and can be used in the field of medicine, namely in roentgen equipment intended for [diagnostics] the diagnosis and [inspection] management [ill,] of various conditions. More specifically , it can be used for the monitoring [over condition] of endo-prosthetic appliances, internal surgical [wields] joints and connections, and of post-surgical [area] areas of the body in order to avoid leaving [a] surgical [napkin] napkins, [tampon] tampons, or surgical instructions inside the body of a patient . The invention can also be used [for selection of] to select [of exposure] areas to be exposed in the course of [radio-therapy] radiation therapy, etc., as well as [for production of] to produce protective [uniform] uniforms (aprons, smocks, waistcoats, caps, etc.) [, protection] and protective shields, partitions, [protection] protective coatings [coating], isolation materials, etc.

[Previous level of engineering.] Description of the Prior Art.

[Known] Already known is an X-ray absorbing material [, for example, under the Patent of Sweden] as disclosed in Swedish Patent No. 349366, which provides [, 1960, providing] for an artificial rayon thread [which] that contains barium sulfate ($BaSO_4$) [in the form of] as a mechanical impurity (15 % through [up to] 65% of total mass). However, adding [the mentioned] this mechanical

impurity to the textile base of the material results in an abrupt reduction of [its] the material's durability.

[Known] Also known are X-ray absorbing materials [, executed], for example, in the form of threads [which] that contain bismuth oxide, colloidal silver, and iodine derivatives – all [as] in the form of X-ray contrasting impurities added to [the] a polymeric composition ([ref. of] see, for example, the X-ray absorbing materials described [, for example,] in the Abstract of A.V. Vitulsky [, Master of Science, named] entitled "Obtaining and [research] researching of synthetic fibers with [the] X-ray contrasting and anti-germ [preparations] solutions being added at the time of [forming] preparation," Leningrad, 1974). However, [examining] an examination of the properties of a textile base containing such impurities [has shown] reveals that [due to violation of the] because the homogeneity of the fiber structure is violated, which is caused by the negative influence of [contrasting impurity] particles of contrasting impurity, [the worsening of] the physical and mechanical properties of the fibers and threads made on the basis [base] of [the mentioned] such impurities are degraded [takes place]. A textile base containing such impurities lack durability , and this [factor] limits the [field] range of [application] applications this base can have [thereof].

[Known] Another known example of the prior art is an the X-ray absorbing material [, for example, under] disclosed in the Bulgarian Certificate of Invention [Authorship of Bulgaria] No. 36217 [,] (1980) , made in the form of a thread containing [X-ray protection] a protective coating against X-rays produced [of] from heavy metals [, plotted] that have been derived by means of [falling out in] crystallization from corresponding [salts solutes] salt solutions. Unlike the materials mentioned above, this one [has] displays better physical and mechanical properties [since] because the derivation of the coating by crystallization of the heavy metals from solutions [plotting of the coating by falling out of

heavy metals from solute] does not [really] substantially affect the mechanical properties of the initial material. Nevertheless, the [small width] thinness of the coating causes [the lowered] a lessening of X-ray contrasting and X-ray protection properties. Furthermore, [the weak adhesion of the X-ray absorbing coating towards] after washing, cleaning and so on, the X-ray absorbing coating adheres only weakly to the initial material, and this causes an abrupt reduction of the X-ray contrasting and X-ray protective properties.

[Known] Another known example of the prior art is [an] the X-ray absorbing material disclosed in Soviet [under the] Certificate of [Authorship] Invention No. 1826173 A61Б 17/56, 17/00 [, U.S.S.R.,] (1980) , which [, having] has the merits of a material [made] in the form of [the] a thread containing the X-ray absorbing coating of heavy metals, but lacks [is devoid of] its drawbacks . This is due to the fact that the X-ray absorbing coating is made of ultra - dispersible particles (UDPs) [with] of sizes [of] between 10^{-6} and 10^{-7}m and [having] displays such properties as the [like] abnormal weakening of radiation, [according to] as stated in "The phenomenon of abnormal reduction of X-radiation by an ultra - dispersible environment" (Diploma No. 4 of the Russian [Natural Science] Academy of Natural Sciences, priority date - 05/07/87). The metal-containing element ([size of] between 10^{-6} and 10^{-7}m in size) , a finely dispersible mixture of this material , is bonded to the surface of the thread , i.e. , on the [textile base] surface of the textile base. However, the use of a finely dispersible mixture only in the range of ultra - dispersible particles (between 10^{-6} and 10^{-7}m in size) [, which] that are chemically and physically fissile and pyrophoric/combustible [,] is technologically problematic [since] because it requires special conditions of manufacture, [transporting] transport, storage and technological application.

[As a result of the] The recent discovery in the field of physics of the poly-dispersed environment, entitled [named] "The phenomenon of the abnormal alteration by mon- and multiple environments of permeating radiation quantum stream intensity [abnormal alteration by mono- and multiple environment]" (Diploma No. of the Russian [Natural Science] Academy of Natural Sciences, priority date - 09/19/96) [it was ascertained] caused the discovery that the poly-dispersed environment, [provided] assuming that [the] a certain level of dispersibility of particles and segregation thereof by intermixing is ensured, [also reveals the capability of] displays a capacity for an abnormally high reduction of X-ray radiation. [, which is conditioned by] This is caused by the fact that [self-organization of] the poly-dispersed particles, having a size of between one thousandth and hundreds of micrometers, organize themselves into energetically interconnected X-ray absorbing [ensembles] groups. ([Segregation] "The segregation of poly-dispersed particles [denotes]" means an irregular distribution of the poly-dispersed [mixture] particles caused by the intermixing of the mixture [,] that is due to the particles' self-organization into [the] a system of energetically interconnected [ensembles] groups, ensuring [the increasing of] an increase in [the] photo-absorption [cut].) [Meanwhile it] It is generally known in modern engineering that the use of poly-dispersed mixtures that consist [consisting] of particles having a size of between 10^{-9} through 10^{-3} m [in modern engineering] does not require any specific limitations and is not fraught with [any] specific technological difficulties in manufacture, transport[ation], storage and use.

[Known] U.S. Patent No. 3,239,669 discloses an X-ray absorbing material containing [, for example,] a rubber matrix with a fixed X-ray absorbing filler [under the U.S. patent No. 3239669, 1966]. According to [the] this patent, [the] X-ray absorbing elements in the form of lead, bismuth,

silver and tungsten can be used as a filler. The main drawback of this example of the prior art [the mentioned material] is [reduction of] that it reduces the solidity of the material [in 2-3 times] by a factor of two to three times due to the fact that [negative influence of] the absorbing particles of filler have a negative influence by violating the uniform structure of the original polymeric mass.

[Known are another] U.S. Patent No. 2,153,889 discloses other X-ray absorbing materials. These contain [containing] a matrix with a fixed X-ray absorbing filler or [, for example,] in the form of [golden] gold tubes [, under the U.S. patent No. 2153889, 1939 or in the form of] . U.S. Patent No. 3,194,239 discloses an X-ray absorbing material in the form of a wire [made] consisting of alloys that contain silver[-], bismuth[-], tantalum[-containing alloys], wherein the [said] wire and the matrix are fastened together by interweaving and forming a kind of [a] textile thread [(U.S. Patent No. 2194239, 1965)]. Materials containing a matrix with a fixed X-ray absorbing filler [in the form] of wire made of silver-, bismuth-, tantalum-containing alloys [,] where [in] the [said] wire and [the] matrix are fastened together by interweaving and [are forming] form a textile thread [,] are preferable [in comparison with] to the materials [under] disclosed in U.S. Patent No. [2152889] 2,153,889, [if taking into account such property as] with regard to their solidity, but have a lower plasticity [, which]. This lower plasticity is inadmissible in many cases.

[Known] Also known are materials [protecting] that protect from the impact of X-ray and gamma [-] radiation [containing] with heavy fillers, the most widespread of which is [, for example,] lead ([Article named] See "Technical headway in atomic engineering." In ["Isotopes in U.S.S.R."] *Isotopes in the U.S.S.R.*, [edition] vol. 1 (72), p. 85). [Due to the great difference between a] A filler (for example, lead) and a matrix (for example, concrete, polymers, etc.) differ greatly in density, and

therefore the filler (lead) is [being] spread irregularly along the matrix volume [irregularly], which results in a decrease [of] in the X-ray absorbing properties of the material as a whole.

[Known is] United Kingdom Patent No. 1260342, G 21 F 1/10 discloses an X-ray absorbing material [executed, for example,] produced on the basis of [the] a polysterol polymeric matrix and a lead-containing organic filler [, under the U.K. patent No. 1260342, G 21 F1/10, 1972]. [The said] This material has the same drawback as the lead-containing fillers described in [the article] "Technical headway in atomic engineering." [Series "Isotopes in U.S.S.R.," 1987, edition 1(72), p. 85) cited above – it also shows an [which consists in] irregular distribution of a heavy X-ray absorbing filler inside the matrix, the material of which has a considerably lower density than the material of the filler.

[The closest] Closest to the [offered] present invention is Russian Federation Patent No. 2053074 G21 F 1/10 of 06/27/96 (prototype), which discloses an X-ray absorbing material containing a matrix with [the] a fixed X-ray absorbing metal-containing filler in the form of dispersed particles [, under the Russian Federation patent No. 2063074 G21 F 1/10 of 6/27/96 (prototype)]. The drawback of [said] this material [consists in the fact] is that [adding] the addition of a lead-containing filler to a textile base results in a reduction of the density of the material due to the violation of the uniform structure of the textile base [uniform structure,] that in turn limits [, in its turn] the possibility of [the use thereof] using the material for the manufacture of various protective [means] articles. [Material] A material made [executed] on the basis of a thread with [a] lead-containing filler cannot be used as an X-ray contrasting material in the practice of medical radiology due to the lead's toxic properties. Furthermore, it is impossible to [create effective compact protection from] effectively and compactly protect against X-ray and gamma-radiation on the basis of such material as a thread ([analogue thereof,

for example, is described in the] see Russian Federation Patent No. 2063074) [as], and in this case [for purposes of using the said thread material], in order to use the material made from thread it is necessary to apply the special technology of dense , multi-layer machine knitting for the manufacture of multipurpose protective textile tissue. [But thus] In this way, however, [as] because the [weakening of a] narrow bundle of quantums by a stratum of material having a width = X [happens according to the exponential law] weakens exponentially, in compliance with the [legitimacy] described rules set forth in [the book] ["] *Methods of radiation granulometry and statistical simulation in research [of] on the structural properties of composite materials* [."] (V.A. Vorobiev, B.E. Golovanov, S.I. Vorobieva [,] ; Moscow [,] : Energoatomizdat, 1984), [happens] there occurs a reduction [of] in radiation intensity:

$$I = Io\ e^{-\mu x} \qquad (1)$$

Where

I is the intensity of radiation [passed] that passes through a stratum of material having a width = X,

Io is the intensity of the initial radiation,

μ is the linear factor of radiation reduction (weakening ; [) (] the tabular regulated value for each of the X-ray absorbing materials).

[The] Another drawback of this [prototype] example of the prior art consists [also in] of the high percentage of the [a] metal-containing filler in the total amount of the X-ray absorbing material (a percentage of 66 % - 89%) [, that] . This [will cause] causes an increase [of] in the mass of X-ray absorbing material as a whole, and , on the other hand, the articles made out of [such] this material and heavy and inconvenient [in maintenance] to maintain. Still a further drawback of this example of the

prior art is the [The] irregular distribution of the heavy filler in the matrix volume [is one more drawback of the mentioned prototype].

[Disclosure of the invention.]

SUMMARY OF THE INVENTION

The main tasks in [the course of development of] developing X-ray absorbing (i.e. , X-ray contrasting and X-ray protective) materials are:

- to eliminate the [toxicability] toxicity of [an] the X-ray contrasting material [,] ; and
- to reduce the mass and width of [a] the protective material.

[Elimination] The elimination of [toxicability] toxicity is achieved [through] by means of the application of non-toxic fillers (tungsten, for example). [And] On the one hand, the creation of [compact] a compactness of protection with the width of the protective material [width] reduced [together with saving of] at the same time that the degree of X-ray and gamma radiation is reduced [X-ray absorbing properties (i.e. X-ray and gamma radiation)] leads to [increasing of] an increase in the mass of the material protective layer [mass] caused by the use of "heavy" fillers, i.e. , [filler] fillers of high density. [Vice versa] On the other hand, when the X-ray absorbing properties are [saved] conserved, the reduction of the density of the protective material [density causes the necessity of] makes necessary increasing [of] its width.

[Let's illustrate this] This position can be illustrated with [on] an example of an X-ray absorbing material in the form of a protective textile tissue (a radiologist's protective apron, for example) [which] that ensures a level of protection characterized by the reduction factor K = 100. It is possible to [deduce] move from Formula (1) as follows:

$$K = Io/I = e^{\mu x} = 100,$$

[Whence] from whence it follows that:

$$x = \ln K/\mu = 4{,}6/\mu.$$

As an example, [let's] compare the properties of tissues made of threads containing [the] known fillers in the form of non-segregated dispersed particles of lead (Pb) and tungsten (W). The size of the tissues compared [tissues] was set as 10 X 10 cm. The [rest] initial data for comparison are shown below, in Table 1.

[Table 1.]

TABLE 1

Initial Data for Comparison

Materials used for the particles of filler	Linear factor of radiation reduction -1 – (weakening), μ, cm*	Particles' material density ρ g/sm^3
Pb	40,3	11,34
W	50,1	18.7

*[) Remark: radiation] NOTE: Radiation source is an X-ray emitting (roetgen) tude, energy – 60 keV.

Using the data shown in Table 1, it [It] is possible to deduce from Formula (2), [using the data of Table 1,] the values of width X for tissues made of threads with a filler [made] consisting of:

Pb (X = 0,11 cm) and [of] W (X = 0,09 cm).

Accordingly , the mass of such [protection] protective tissues with a volume of 10 X 10 X 10 will [constitute] be:

For Pb – 124,74 g, and for W – 168,3 g.

If the mass of a [protection] protective tissue using [on the Pb basis] Pb is taken [for] as 1, then ([by] according to the equal protective properties and equal sizes) the ratio of the mass of tissues made on the [base] basis of threads containing Pb and W [--] will be 1:1,35.

Thus, it is impossible to obtain the simultaneous reduction of the width of the protective material [width] and its mass using the [prototype] prior art and known [similar] technologies.

According to the present invention , the [set] tasks that must be achieved are solved by means of the strategies set forth [mentioned] in the distinctive part of the independent claims [of the invention formula] , as discussed below.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[In a] A first embodiment of an X-ray absorbing material [comprising] comprises a matrix with a fixed X-ray absorbing metal-containing filler [,] . [the said] This material uses as a filler a poly-dispersed mixture that is segregated by intermixing [poly-dispersed mixture containing] . The mixture contains metallic particles having a size of between 10^{-9} and 10^{-3} m, while the textile base serves as a matrix. As this takes place, the particles are bonded to the surface of [said] the textile base , and the density of the X-ray absorbing material as a whole [,] – with the X-ray absorbing properties of the material being equal to those of the material used to the particles of the X-ray absorbing filler [,] – is defined [by the relation] as follows:

$$\rho_m = (0{,}01 - 0{,}20)\ \rho_\rho,$$

where [:} ρ_m [-] is the density of the X-ray absorbing material as a whole, and

[while] ρ_ρ is the density of the material used for the particles of the X-ray absorbing filler.

In a second embodiment of an X-ray absorbing material comprising a matrix with a fixed X-ray absorbing metall-containing filler in the form of dispersed particles, the [said] material uses as a filler [the segregated by intermixing] a poly-dispersed mixture that has been segregated by intermixing. [containing] This mixture contains metallic particles having a size of between 10-9 and 10-3 m, wherein the [said] metallic particles are surrounded by the volume of a matrix [executed] made of at least one component that is solidifying under atmospheric pressure or of a matrix made of the composition [on] that forms the base of [said] this component. As this takes place _, the total mass of the segregated poly-dispersed mixture [consisting] of X-ray absorbing particles of filler [,] is defined as follows [by the relation]:

$$M = (0{,}05 - 0{,}5)\ m,$$

where M is the total mass of segregated poly-dispersed mixture [consisting] of X-ray absorbing particles of filler, and

[while] m is the equivalent mass of the X-ray absorbing filler material equal [by its] in protective properties to [the] mass M.

In a third embodiment of an X-ray absorbing materials [comprising] that is comprised of a matrix with a fixed X-ray absorbing metal-containing filler in the form of dispersed particles, the [said] material uses as a filler [the segregated by intermixing] a poly-dispersed mixture that has been segregated by intermixing and that contains [containing] metal particles having a size of between 10'9 [up to] and 10-3 m [, wherein the said] Here, the particles are bonded to an intermediate substrate [which is] surrounded by a [the] volume of matrix [executed] made of at least one compound that is solidifying under atmospheric pressure or a matrix of the composition [on] that forms the base of [said]

this compound. A textile base serves as an intermediate substrate. A mineral fiber can also be used as an intermediate substrate.

The [attributes] embodiments set forth above related to a range of inventions that are all interconnected by the [common author's] inventors' common conception. [As this takes place,] In this way, [the said] this range of inventions consists of a single [objects of one] type and [appliance] application, [ensuring] one that ensures the same technical result, namely [:] , the elimination of toxicity in [exclusion of toxicability of] an X-ray contrasting material and the reduction of mass and width [of a] in a protective material [,] which [is the] are all necessary requirements for [an] the invention that is represented by these [variants] embodiments.

[Inventions realization variants.]

The various embodiments of the three presented embodiments of the present invention can be explained in a more detailed way as follows.

In a first embodiment of the X-ray absorbing material , [the execution of] a filler is created in the form of [segregated by intermixing] a poly-dispersed mixture that has been segregated by intermixing . The fact that this mixture is comprised of [comprising] metallic particles having a size of between 10^{-9} [up to] and 10^{-3} m ensures [the manifestation of a qualitatively new effect by] that the X-ray absorbing filler will evidence the filler's qualitatively new feature: [increasing of the cut] an increase in the filtering of interaction between the X-ray and gamma ray [emission] emissions and [substances] substances. Due to [the mentioned] this effect, [the increasing of] the material demonstrates a capacity for increased [specific properties of] X-ray absorption [with the offered material is achieved].

The use of poly-dispersed mixtures as [a] filler is [widely applied] much used in the X-ray

absorbing materials described [, for example,] in [the] Russian Federation [patents] Patents No. 2063074 and 2029399, where[of the] non-segregated particles [having] with a size [of] between 10^{-6} [up to] and 10^{-3} m are used. However, in [the said materials] this invention these particles [the above mentioned attribute is used in purpose of more] are used to cause the more regular distribution of the X-ray absorbing filler along the surface of a matrix or inside [thereof] it.

In the X-ray absorbing metal-containing material defined [herein] in the present invention, the [segregated by intermixing] poly-dispersed mixture that has been segregated by intermixing ensures not only the more regular distribution of the X-ray absorbing filler along or inside the surface of a matrix [or inside thereof] but also provides for [manifestation] the evidencing of a qualitatively new effect [-] : [increasing the cut of] an increase in the reduction of the interaction between the X-ray and gamma -ray [emission] emissions and [substance] substances.

[The] A finely dispersible mixture of metal-containing [element] elements ([sizes] sized between 10^{-6} and 10^{-7} m) is used in the known [analogous] material [under the U.S.S.R.] employed in Soviet Certificate of [Authorship] Invention No. 1826173 . This mixture is bonded to the textile base surface. Unlike the [said analogous] this material, [under] this [the offered] present invention uses [the] a poly-dispersed mixture made of particles having a wide range of sizes [of wide range]: the range of 10^{-9} [up to] and 10^{-3} m [,] is used. [As this takes place] Thus, [the] particles having sizes [of] within the above mentioned range are included within [into] the common mixture. Consequently, there seem to be no technology obstacles to working with such a mixture under [common] standard, natural conditions [does not reveal any technology obstacles, i.e., the [said] does not demonstrate physical and [/or] chemical activity. In particular , this mixture [it] does not manifest pyrophoric/combustible properties.

[Under] In the [offered] present invention, the use of a [the segregated by intermixing] poly-dispersed mixture that has been segregated by intermixing and having sizes in the range of 10^{-9} [up to] and 10^{-3} m provides for a qualitatively new effect, if compared with the [said] analogous material used in Soviet [under the U.S.S.R.) Certification of [Authorship] Invention No. 1826173. This effects consists in obtaining the same abnormal X-ray absorbing properties.

[Side by side with this, the] The dispersed particles of the analogous material of [(acc. To the U.S.S.R.] Certificate of Invention No. 1826173 [)] are bonded to the thread surface, i.e., to the surface of a textile base. [However,] In contrast, [under] in the [offered] present invention not only [a thread] threads but also separate filaments of a thread [thereof] can be used as a textile base [,] – i.e., the notion "textile base" [grasps] includes not only thread [as well as] but also separate filaments. (According) The present invention shows [in the case of] separate filaments to be coated [coating] by an X-ray absorbing filler. [(and, what is more] Furthermore, these filaments do so in the form of [segregated by intermixing] a poly-dispersed mixture that has been segregated by intermixing [with self-organization] and that contains poly-dispersed particles self-organized into energetically interconnected power-consuming groups [ensembles] . [and provided] Provided that the filaments [would] twist into a thread, [the said] that thread shall have [the] qualitatively new and higher specific X-ray absorbing properties [of a qualitatively new, higher level,] in comparison with the [analogous] material [under the U.S.S.R.] in the Soviet Certificate of [Authorship] Invention No. 1826173.

[So] Therefore, [using] the use of a textile base as a matrix, where [with] the X-ray absorbing , metal -containing segregated particles of filler [being] are to the surface thereof, ensures a qualitatively new effect [(differing from the prototype)] , one that differs markedly from the prior art and

[which finds expressed] is manifested in the higher X-ray absorbing properties of the material , which is characterized by extreme heightened specific properties of X-ray absorption.

In Soviet Certificate of Invention [Under the U.S.S.R. Certificate of Authorship] No. 1826173 , an X-ray absorbing coating of [the] a thread-matrix surface is provided. [As for the] The X-ray absorbing material offered [herein,] by the present invention the matrix can be formed by not only a textile base [not only] in the form of whole thread [as a whole can be used as a matrix], but also a textile base in the form of the separate filaments of which the thread consists (as mentioned above). A thread made and twisted [out of] from separate filaments each coated [by] with an X-ray absorbing filler [has] displays much [higher] greater X-ray absorbing properties than a thread where only the open surface thereof is so coated [with an X-ray absorbing filler (] . In the present invention, [unlike the offered material, where] the surface of each filament included [into] in the thread is coated [by] with an X-ray absorbing filler [)]. Moreover, the surface of each filament is covered by dispersed particles that have been segregated by intermixing. As a result , the [said] dispersed particles are self-organized into the energetically interconnected X-ray absorbing groups (ensembles) [,] and this, in [its] turn, [ensures] causes the extreme [heightening of] increase in the specific characteristics of the X-ray absorbing process.

The embodiment of the [Realization of an] X-ray absorbing material as a whole, [at same] with simultaneous X-ray absorbing properties [of] for this material and for the filler material, can be seen in the following way. If the density of the filler is defined by the relation:

$$\rho_m = (0,01 - 0,20)\ \rho_\rho,$$

where ρ_m is the density of the X-ray absorbing material as a whole [,] ; and

[while] ρ_p is the density of the material used to the particles of the X-ray absorbing filler, then [creates] a qualitatively new effect ([if] when compared with the [material of the prototype] prior art materials) is created, namely , the simultaneous reduction of the width and the density of a protective material [.] [The simultaneous reduction of width and density of a protective material woven, for example, of an X-ray absorbing thread, ensures overcoming] , which, in turn, makes it possible to overcome the main contradiction inherent in the process of creating compact protection against X-ray and gamma-radiation. According to the [offered] present invention, the densities of the protective materials within [in the form of] a thread and tissues [derived therefrom], depending on [the set] technical conditions, can constitute between 0,01 (upper limit) and 0,2 (lower limit) of the material density of the X-ray absorbing filler particles. If the mass of X-ray absorbing material (in the present [case] embodiment, a protective tissue [executed on the basis of] made from a thread, according to the present invention) is taken [for] to be 1, [then at protective properties and sizes of compared protective tissues being equal to those of the tissue [on the basis of] based on the thread of the present invention [offered thread], [for] and at the conditions set forth in Table 1, the correlation by mass will be [as] defined as in Table 2 , below.

TABLE 2.

Comparative correlation of tissues by [masses] mass at equal protection properties (with regard to the data set forth in Table 1)

Relative limits of oscillation of correlation between the density of tissue made of the [offered] material of the present invention and the density of the material used for the particles of the X-ray absorbing filler	Tissue made of [offered] the material of the present invention	Tissue made of threads with a filler in the form of non-segregated particles of Pb	Tissue made of threads with a filler in the form of non-segregated particles of W
Upper limit (0,01)	1	198	267
Lower limit (0,2)	1	9.9	13,35

[So,] Thus the [offered] X-ray absorbing material (tissue) of the present invention would have a mass [lesser in] between 9,9 [up to] and 267 times ([at the] all other physical and chemical parameters being equal) [, if] when compared with the [protection] protective tissues [on the basis of] based on threads with a filler [in the form] of non-segregated particles of Pb and W. [The mentioned] This factor ensures a qualitatively new effect.

[Consequently] In consequence, [if] when compared with the [prototype] prior art, the [offered] X-ray absorbing material of the present invention [, demonstrating] demonstrates the absolute absence of [toxicability] toxicity, ensure [high] a great deal of solidity equal to the solidity of the X-ray absorbing textile base [plotted] shown above. Furthermore, [it] the present invention ensures [the] abnormally high X-ray absorbing properties [at] with a concomitant low density.

In a second embodiment of X-ray absorbing material , the use of [segregated by intermixing]

poly-dispersed mixture segregated by intermixing, one comprised of [comprising] metallic particles having a size [of] between 10^{-9} [up to] and 10^{-3} m (as in the embodiment set forth above) , ensures the manifestation of a qualitatively new effect [by the used X-ray absorbing filler – increasing of cut of] in cutting down the interaction between [the] X-ray and gamma-ray [emission and substance] emissions and substances.

[The] First, the poly-dispersed mixture [containing] with metallic particles sized [having a size of] between 10^{-9} [up to] and 10^{-3} m [, being] are placed inside a matrix volume, [wherein] where the matrix is [made of] composed of either at least one component [solidifying] that solidifies under atmospheric pressure or [of] a composition formed on the basis of [said] that component . [, excluded is violation of] The energetic X-ray absorbing [ensembles] groups formed by intermixing and creating a [made of the X-ray absorbing element particles] segregated poly-dispersed mixture should not be violated in any way. [Meanwhile, this] This promotes the self-organization of [said] the energetic X-ray absorbing [ensembles] groups.

An inorganic glue [, such as the] can be used as a matrix. Suggested glues include: Na silicate and K silicate water solute, or water suspension of compositions containing oxides of alkaline metals and earth metals, as well as compositions made on the [base] basis of such [glue] glues [, can be used as a matrix].

The natural polymers [, such as] can also be used as a matrix. These include: collagen, albumin, casein, gum, wood pitch, starch, dextrin, latex, natural caoutchouc, gutta-percha, zein, soy casein, as well as compositions made on the [base] basis of such polymers [, can also be used as a matrix].

[The synthetic] Synthetic polymers, such as polyakrylates, polyamides, polyethylenes,

polyethers, polyurethanes, synthetic rubber, phenolformaldehyde, resin, carbomid resins, calibration epoxy and compositions based on such polymers [,] can also be used as [a matrix] <u>matrices</u>.

Element -organic polymers [, such as] <u>–</u> including silicon-organic polymers, boron-organic polymers, metal organic polymers and compositions based on such polymers<u>–</u> [,] can also be used as [a matrix] <u>matrices</u>.

Plastics filled with gas, such as foam plastic and expanded plastic, can be used as [a matrix] <u>matrices</u>.

Vegetable oils or drying oils can be used as [at matrix] <u>matrices</u>.

[Solutes] <u>Solutions</u> of film-generating substances, such as oily, alkyd, ether-cellulose lacquers, can be used as [a matrix] <u>matrices</u>.

Concrete, [gyps] <u>gypsum</u> and so on can be used as [a matrix] <u>matrices</u>.

[According to the] <u>The present</u> invention <u>as</u> defined herein<u>, uses</u> [using the] <u>a</u> matrix made of <u>a</u> [solidifying] compound [, unlike the material-prototype under the Russian Federation patent No. 2063074, takes place] <u>that solidifies</u> under atmospheric pressure, i.e., under natural conditions <u>.</u> <u>In contrast, in the material in the prior art of the Russian Federation patent No. 2063074, the matrix solidifies under a</u> pressure of 150 mPa [like according to the prototype]. [According to] <u>In</u> the <u>present</u> invention [defined herein] the mixtures [is] <u>does</u> not [underwent] <u>need to undergo</u> pressure [like the] <u>as do</u> the [protection] <u>protective</u> rubbers [as] described in [the] Russian Federation Patents Nos. 2077745, 2066491 [,] <u>and</u> 2069904 <u>,</u> which [are] <u>all</u> underwent vulcanization under pressure after <u>the</u> preparation of the mixture. [Consequently,] <u>The avoidance of high-pressure treatments</u> helps to avoid [destroying] <u>the destruction</u> of <u>the</u> energetic X-ray absorbing [ensembles] <u>groups that are</u> formed

in the course of intermixing [of] X-ray absorbing element particles in a segregated poly-dispersed mixture. [The same distinction of invention defined herein from the analogous material under the U.S.S.R. Certificate of Authorship] The present invention distinguishes itself in the same way from Soviet Certificate of Invention No. 834772 [takes place], [since] as according to [the mentioned] that Certificate, [an] the X-ray absorbing material is obtained under a pressure of 150-200 kg/cm^2.

In [an analogous] a similar material in [under the] U.S. Patent No. 3,194,239, the pressed pills of previously crumbled-up iron-manganese (IMC) are used as an X-ray absorbing filler, which [is different] differs from the present invention [defined herein]. [Effect of] The effect of pressure on the filler [of an analogous material under the] used in Russian Federal Patent No. 20293399 also [results in] makes it impossible for [impossibility of] the [energetical ensembles] energetic groups [self-organizing] to self-organize, [(however it takes place in the offered invention)] as they do in the present invention. Thus, [application] the present invention, [as] having a matrix of at least one compound [solidifying] that solidifies under atmospheric pressure, or of compositions [on its base in the offered invention has] based on this compound, displays essential differences from the material used in the prior art [prototype] as defined in [the] Russian Federation Patents No. 2063074.7, and from the [analogous] similar [materials] material found in [under the] Russian Federation patents Nos. 2029399, 2077745. 2066491 [,] and 2069904 , with respect to their particular [in part of respective] functional properties.

[Realization of a] Let us assume a condition, [at] in which the common mass of the segregated poly-dispersed mixture [consisting] consists of the material formed of X-Ray absorbing filler particles [material] . Define this condition [is defined] by the relation :

$$M = (0{,}05 - 0{,}5)\ m,$$

where M is the total mass of segregated poly-dispersed mixture consisting of the X-ray absorbing particles of filler; and

[while] m is the equivalent mass of the X-ray absorbing filler material , which is equal [by its] in protective properties of mass M [,] .

[- will] This condition will allow (according to the second [variant] embodiment of the X-ray absorbing material) [to reduce a] The reduction of the mass of known X-ray absorbing fillers in [protection] protective materials [in] by a factor of 2 [up] to 20 times, depending on the particular technical and at saving an X-ray and gamma-ray radiation reduction factor.

Reduction of the mass and the width of the protective [protection] material can be regarded as the main objective [while] in construction protection from roentgen- and gamma-radiation. [However,] The fact that [creation of the] compact protection [having] displays a diminished layer thickness [of layer] leads to an increase [of] in the protective layer mass [because] due to the usage of known heavy fillers. [And, vice versa,] In contrast, saving [of a] the roentgen- and [the] gamma-radiation reduction factor [at] by lowering the density of [a] the material makes necessary [entails necessity of] increasing the width of protection. [And the] This is the main [inconsistency arising while creating] dilemma that arises in attempting to create effective compact protection from roentgen- and gamma-radiation, as the simultaneously reduction of both width and mass [of] in an X-ray absorbing material practically cannot be achieved with the known fillers [applied] used for protection. This [inconsistency] dilemma requires [some] a compromise approach [as to] in the choice of [protection] protective width and mass , also allowing for the [with allowance for a] cost of such protection.

[Let's illustrate this] This problem can be illustrated with [on] an example of [the most] a common material [applied in purpose of protection] used for the purpose of protecting against gamma-radiation, such as concrete. The [Density] density of different sorts of the usual Portland concrete, [containing] which contains cement as a connecting substance and [the] silicon shingle, gravel, quartz sand and similar mineral fillers, [constitutes] is 2,0 -2,4g / cm^3. [A] The linear gamma-radiation reduction factor [constitutes] is 0,11 - 0,13 cm^{-1} (for [energy] energy levels of 1 - 2 MeV). [The protection] Protection made [with] of concrete [having] has such a density that it is quite [cumbrous] cumbersome and should have considerable width. The concrete [containing] that contains cement as a connecting substance, sand as a filler and galena as an X-ray absorbing filler in [the] a ratio of 1: 2: 4has [the] a density of 4,27 g/cm^3 [,] and [the] a linear reduction factor [thereof constitutions] 0,26 cm^{-1}(for [energies] energy levels of 1,25 MeV). [The] With concrete-containing cement as a connecting substance, sand as a filler and lead as an X-ray absorbing filler in [the] a ratio of 1: 2: 4 and has a density of 5,9 g/cm^3 [,] and [the] a linear reduction factor [thereof constitutes] 0,38 cm^{-1} (for [energies] energy levels of 1,25 MeV). The [protection] protective material made of concrete with a lead filler [in the form of lead] (leaden fraction) or galena is more compact, but such [protection] protective material is [too] much more expensive than the usual concretes.

[Such] An X-ray absorbing filler such as the baryta $BaSO_4$ [allows to solve] makes possible the resolution of choosing an appropriate width and mass of [protection] protective material [with allowance] , which allowing for its cost. Though the appropriate solution can be found only on the palliative level. The [barytes] baryte concrete , which contains [containing] as fillers sand and gravel, and the baryta as an X-ray absorbing filler, has a densite of 3,0 - 3,6 g/cm^3 [and the] . The linear

reduction fact [thereof constitutes] is thus 0,15 - 0,17 cm^{-1} (for [energies] energy levels of 1,25 MeV). However, the total mass of the baryte [the barytes] concrete protection [total mass] of set gamma - [quantums] quantum energy [value] values remains considerable, which causes serious difficulties [while] in creating [protection] protective material, especially the protection of transport facilities.

[The above-stated inconsistency] The above dilemma could be overcome [, when the] if iron-manganese concretions [are] were to be used as an X-ray absorbing filler, for example, as [defined] disclosed in [the patent of] Russian Federation Patent No. 2029399. But even in this case it is impossible to reduce [a] the total mass of [a] the protective material by more than [by] 20 - 45%, [if] as compared with [the] known and conventional materials.

[However according] According to the [offered] present invention, however, the correlation that exists between [of a] the total mass of segregated poly-dispersed mixture consisting of particles of an X-ray absorbing material [particles with] and the formula set forth above allows [to reduce] for the reduction of [a] the mass of the known X-ray absorbing fillers included [into] in protective materials [known X-ray absorbing fillers in] up to 2 [up] to 20 times, depending on particular technical conditions and with savings in [at saving an] X-ray and gamma-ray radiation reduction [factor].

The technical outcome of the second [variant] embodiment of the invention is [obtaining of] that an X-ray absorbing material with a low percentage of a metal-containing X-ray absorbing filler is obtained. This [effect] provides for the reduction of the width and mass of [an] the X-ray absorbing material as a whole without the aggravation of any X-ray absorbing properties.

In a third embodiment of an X-ray absorbing material , the use of a poly-dispersed mixture that has been segregated by intermixing , one comprising metallic particles having a size [of] between

10^{-9} [up to] and 10^{-3} m as a filler [,] (as [was described above] has been described) , [provides for manifestation of] makes possible the qualitatively new effect of the [used] X-ray absorbing filler used, namely, [increasing cut] a substantial diminishment of the interaction between the X-ray and gamma-ray [emission and substance] emissions and substances.

The bonding of a segregated poly-dispersed mixture , [consisting] of the X-ray absorbing substrate particles to the intermediate substrate , promotes [obtaining] the ability to obtain an X-ray absorbing material with the even distribution of [the] heavy X-ray absorbing metal-containing filler inside the matrix having considerably smaller density [,] that the material of the filler.

[Allocation] The distribution of [the] this poly-dispersed mixture [comprising] comprised of metallic particles having a size [of] between 10^{-9} and 10^{-3} m inside the volume of a matrix [executed] made of at least one compound [solidifying] that solidifies under atmospheric pressure or made of [the] a composition [on the base of] based on said compound [,] eliminates (as was described above) [violation of the formed at intermixing] the possibility that there will be a violation of the energetic X-ray absorbing [ensembles] groups [consisting] that consist of the poly-dispersed mixture of the X-ray absorbing element particles [poly-dispersed mixture and] . This distribution also promotes the self-organizing of energetic X-ray absorbing [ensembles] groups.

A textile base and a mineral fiber can be used as an intermediate substrate [under] according to the third [variant] embodiment of the invention.

The above description of embodiments of an X-ray absorbing material [variants] confirms the possibility [of the invention realization] that the invention can be realized in practice, since only [the] resources known [on date of] at the time of the invention's creation [of the invention] are used.

[Besides,] In addition, it is shown above that the totality of components [tags describing] described as the [an] essence of the invention [,] is sufficient for the solution of the [set] task at hand.

The above [stated variants] embodiments of the invention can be illustrated [on] with the following examples.

Example 1. A filler in the form of [segregated by intermixing] a poly-dispersed mixture segregated by intermixing, made of tungsten particles, is bonded to [the] a matrix surface [executed] made in the form of a twisted lavsan thread. For this purpose, a thread is [to be] put for [a period of] 10 minutes into [the] a pseudo-liquefied (boiling [)(]; under the effect of a heavy air stream) stratum of a poly-dispersed mixture [of] . This mixture has the following faction structure: 20 microns - 15%; 45 microns - 80%; 500 microns - about 5%; 1000 microns - 0,01%.

[In] Under these conditions the segregation of particles [happens due to] occurs because of the fact that [said] these particles [self-organizing] organize themselves into interdependent [power] powerful X-ray absorbing [ensembles] groups. [Meanwhile] At the same time, [such] these particles are attracted to the thread [, therefore they] and are therefore "welded" [on] to its surface. The [treated thus] thread, thus treated, gains the properties necessary for providing an abnormal reduction of X-ray radiation.

[Data] The initial data of the experiment:

Diameter of [a] the thread - 0,3 mm;

Length of [a] the thread - 3200 mm;

Weight of [a] the thread before [plotting] determining the level of mechanical impurity

from tungsten - 0,110 g;

With of [a] the thread after [plotting] determining the level of mechanical impurity from tungsten - 0,160 g;

Solidity of [a] the thread before [plotting] determining the level of mechanical impurity from tungsten - 47 H,

[the same] Solidity of the thread after [plotting] determining the level of mechanical impuritty from tungsten - 47 H.

[As this has taken place] Therefore, the mass density of the groups [ensembles] of tungsten particles on the [thread] surface of the thread [has constituted] is 0,0017 g/cm^2, the size of the thread – 0,22 cm^3, and the density [thereof] of the thread, taken as a whole: p = 0,7 g/cm^3.

After treating the [obtained] sample of thread with the stream of quantums [with the] having an energy level of 60 keV and after fixing [of] the outcomes on [a] roentgen film, [the densitometry in comparison with] a measuring of densities between the standard leaden plates of [different width (stepped weakener of] differing widths (a gradual weakening from 0,5 mm Pb up to 0,5 [weakener with step] with 0,05 Pb) [has been executed] is performed. [In outcome] As a result, it is ascertained that theX-ray absorption level of [a] the thread is equivalent to a leaden plate having a width of 0,1 or 0,075 mm W. Accordingly, this [accordingly, that] testifies [about] to the abnormally high X-ray absorbing properties of [a] the thread.

Furthermore, according to the [formula] claims of the invention

$$\rho_m = (0{,}01 - 0{,}20)\ \rho_\rho,$$

where ρ_m is the density of the X-ray absorbing material (in [our] this case [-], a thread) as a whole, and

[while] ρ_ρ [-] is the density of the X-ray absorbing filler material (in [our] this case [-], tungsten) [;],

we have:

$$\rho_m / \rho_\rho = 0,7/19,3 = 0,036.$$

The [obtained] value [of] obtained for the ratio ρ_m / ρ_ρ [keeps] is within the range of [(] 0,01 - 0,2, which is consistent with [according to] the [formula] claims of the invention.

Example 2. The segregated poly-dispersed particles of tungsten having a size [of] between 10^{-9} [up to] and 10^{-3} m are bonded to a matrix in the form of a textile material ([the] a thick woolen cloth [for] such as that used for an overcoat having a width of 0,4 cm. [Segregation] The segregation and bonding of the tungsten particles to [a] the textile matrix occurs due to [is realized by means of] precipitation [from] due to the presence of hydrosol [in] under conditions of continuous intermixing during the last 15 minutes. Then a sample is [to be] exsiccated at [a] room temperature [within] for one day. The subsequent X-ray testing (at [quantums] quantum energy levels of 60 keV) [has shown] shows that the X-ray protection properties of the [obtained] sample obtained correspond to the [same] properties of a [leaden] lead slice having a width of 0,015 cm. This level of protection testifies [about] to the abnormally high reduction of the X-ray emission stream, since the [indicated] level of protection [at] in the use of a usual non-segregated filler [particles] particle material requires the bonding to a

matrix [of] at the level of 100% of the tungsten by mass (instead of the 53% [, in our] in the present example). Indeed, in the invention according to the present example [according to the invention and in connection with the considered example] the mass of the X-ray absorbing filler [has constituted] is 0,116 g, i.e., 53% of [a] the total mass of [a] the sample, [wherein] where the width of a sample made of a textile material (the thick woolen cloth [for] of an overcoat) [has been] is equal to 0,4 cm [,] and the size of the sample [has been] is 1 X 1 cm^2 and the mass thereof [has been] is 0,216 g. [As this has taken place] Simultaneously, the density of the X-ray absorbing material as a whole [has constituted] is:

$$\rho_m = 0{,}216 / 1 \text{ X } 1 \text{ X } 0{,}4 = 0.54 \text{ g/cm}^3 ,$$

and the mass of tungsten [of] in the non-segregated particles [being] is equivalent [by] in its X-ray absorbing properties [constitutes] to:

$$0{,}015 \text{ X } 0{,}75 \text{ X } 19{,}3 = 0{,}217 \text{ g},$$

i.e., 100% of the mass of [a] the sample of textile material [sample].

It is obvious [therefrom] from this that the relation $\rho_m / \rho_\rho = 0{,}54 / 19{,}3 = 0{,}0279$ corresponds to [a declared] the appropriate stated range.

Example 3. An X-ray absorbing filler in the form of [the] poly-dispersed particles of tungsten having a size [of] between 10^{-9} and 10^{-3} m, the amount = 12% of the mass, is introduced into a filler in the form of hinge rubber of [a] the brand "Ap-24" [having] that has the following structure: C -

84,73%; H - 9,12 %; 5 - 1,63%; N-0,58%; Zn - 2,27%; O_2 - 1,69% and a size of 100 cm^3. The tungsten [Tungsten] particles included [into] in the structure of crude rubber [are underwent] undergo segregation by intermixing in a mixer [during] over the course of 8 hours. As a result, the [self-organizing of] particles organize themselves into [the system of power] X-ray consuming groups [ensembles is achieved].

After that the crude rubber , filled with the X-ray absorbing filler , [has been underwent] undergoes vulcanization without [effect of] being put under pressure. [The subsequent] Subsequent testing (at energy levels of quantums [-] of 60 keV) [has shown] shows that the X-ray protection properties of the [obtained] sample of rubber [having] , which has , a width of 3 mm correspond to the [same] properties of a [leaden] lead slice having a width of 0,11 mm. This level of protection testifies [about] to the abnormally high reduction [of] in the X-ray emission stream, since the [level] of protection [at] in the use [usage] of non-segregated filler [particles] particle material requires adding [to the matrix of] 0,16 g of tungsten to the matrix, i.e., 34% by mass (instead of 12%, as in [our] this case).

Thus, for [a considered] the example [(] :

width of a rubber sample - & = 0,3 cm;

density - p = 1,56 g/cm^3 ;

a mass of rubber [sample having a] with a size 1 X 1 cm [constitutes] having 0,468 g;

and

the total mass of the filler of poly-dispersed particles [material total mass], i.e., 12% of the mass of rubber [rubber sample mass] M = 0,056 g,

an equivalent mass of X-ray absorbing filler [being] equal [by] in protective properties to the mass M, is

equal to m = 0,16 g (34% of the total mass of the rubber sample [total mass]).

It is obvious [therefrom] from this that the relation M/m = 0,056 / 0,16 = 0,35 is well within [corresponds to] the range defined in the claims [formula of the invention] (0,05 - 0,5) [, that dimishes the waste of filler, reduces a mass of protection material as a whole and diminishes the production costs thereof] . Thus, the amount of filler waste is diminished, the mass of the protection material as a whole is reduced, and production costs are diminished.

Example 4. A filler [in the form] of super-thin basalt fiber TK-4, on which [the segregated by intermixing (in a spherical porcelain attritor)] a poly-dispersed mixture that has been segregated by intermixing (in a spherical porcelain attritor) and that is made of tungsten particles having a size [of] between 10^{-9} and 10^{-3} m is [was] fixed, is introduced [inside] into a matrix [in the form] of epoxy priming of [a] the "AP-0010" (Russian Federation Official Standard No. 28379-89). [A] The relation of [a] basalt fiber mass to the [a] mass of tungsten [constitutes] is 1:3. The proxy priming mixture has been carefully [intermixed by] mixed, using a palette [-] knife , with a prepared basalt fiber [, thus] so that the relation of the [a] mass of priming mixture to [a] the mass of [a] fiber [has constituted] is 1:9. After [intermixing] mixing and obtaining [of] a homogeneous mass , the priming mixture [has been] is spread over a surface of cardboard plates [as] in an even stratum [and after] . After solidifying [within] for one day , the mixture is [has been] tested. The X-ray testing of samples (at energy levels of quantums - 60 keV) [has shown] shows that at a priming layer depth [of priming layer] equal to 2,06 mm, the X-ray protective properties [thereof] are equal to 0,08 mm Pb [, that] . This testifies [about] to an abnormally high reduction of the X-ray emission stream, since the [indicated] usual level of protection [at usage] for the use of non-segregated weighing material particles requires adding to the

epoxy matrix 38% of tungsten by mass (instead of 7,5 %, as in [our] this case).

[In a considered] Consider the example [(] & = 2,06 mm [;] _,_ p = 1,46 g/cm^3 [)] _,_ the mass of an epoxy priming [sample] mixture having the size 1X 1 cm^2 [constitutes] is 0,3 g. The total mass of an intermediate substrate with [the] tungsten particles bonded to the [said] substrate [, constitutes] 0,03 g (10% of the mixture's [sample] mass). [As this takes place] Thus, the mass of the tungsten makes up [3/4] three-quarters of [a] the mass of the filler, i.e., 0,0225 g, [that] which constitutes 7.5% of [a] the mass of the mixture [a sample] as a whole.

Furthermore, the mass of tungsten, which is equal to the mass of lead having a width of 0,08 mm, [constitutes] is 0,008 X 0,75 X 19,3 = 0,1158 g, which corresponds to 38,6% of [a sample] the mass of the mixture.

Example 5. [5%] Five percent of the mass of [the] an intermediate substrate in the form of crumbled staple fibers (byproducts of [the] fulling and worsted [industry] industries) has had [to which the] poly-dispersed particles of tungsten having a size [of] between 10^{-9} and 10^{-3} m and having been segregated [within] for 20 minutes by intensive [intermixing] mixing in a pseudo-liquefied layer [were] bonded to it. This five percent is then [are] introduced [inside] into a matrix of dry gypsum. The relation of [a] the mass of staple fibers to [a] the mass of tungsten [constitutes] is 1:3. [The prepared thus] This mixture is carefully [intermixed up] mixed to [obtaining of] obtain a homogeneous gypsum-filamentary mass. [After that water] Water is then added [,] and the mixture is [being] carefully [intermixed] mixed again _._ [and samples having] Samples having a size [sizes of] 1 X 1 cm and a width of 1 cm are [casted] cast [of the obtained liquid substance]. After drying and solidifying _,_ [of] the samples [they are underwent] undergo testing (at energy levels of quantums – 60 keV). [The] X-ray

testing with [the] subsequent matching with [the stepped leaden] gradated lead weakener [has shown,] shows that the [obtained] samples obtained have [the] protective properties equal to those of a [leaden] lead plate [having] with a width of 0,04 cm. This level of protection testifies [about] to the abnormally high reduction of X-ray radiation, since the same level of protection can be [reached at usage] attained with the use of non-segregated particles of [the] filler only [at] with a content of tungsten particles [-] of 26,32% of the mass (instead of 3,75, as in the present [our] case). [For the considered example (] In the example of the width of a gypsum sample [-] = 1 cm, its density [thereof -] = 1,32 g/cm^3 [)] , the mass of [a sample constitutes] the mixture is 1,32 g. Thus , the [mass] share of the mass of tungsten particles in [a sample constitutes] the mixture is:

$$1{,}32 \times 0{,}05 \times 0{,}75 = 0{,}0495 \text{ g},$$

i.e., 3,75% of the total mass of [a sample] the mixture. [At the same time the] The mass of [a] tungsten equal to the mass of a [leaden] lead plate having a width of 0,04 cm (using the [by] results of X-ray testing) is equal to

$$0{,}04 \times 0{,}75 \times 19{,}3 = 0{,}347 \text{ g},$$

[that] which corresponds to 26,32% of the [sample] mixture's mass.

The above-stated examples of particular embodiments of X-ray absorbing materials [embodiment (variant)] and the ways of [obtaining thereof] achieving these embodiments testify [about] to the industrial applicability of [said] these materials in [the indicated area] various areas of engineering.